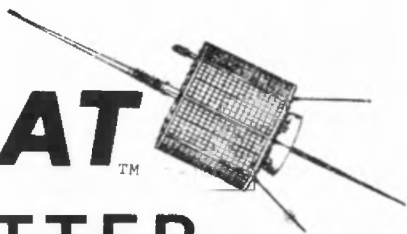




AMSATTM NEWSLETTER



Issued quarterly by the Radio Amateur Satellite Corporation

Volume IX

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IMPORTANT! MEMBERSHIP RENEWAL FORM
AND BALLOT ENCLOSED - SEE PAGE 31.



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Notice to Life Members:

Some of the June Newsletters mailed first-class to Life Members appear to have gone astray. If you did not receive the June issue, drop us a note, and we'll get a replacement copy to you.

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COVER PICTURE

satellite Antennas at
W3HUC. Photo WB4IWF.

AMSAT-OSCAR 7 PHOTOGRAPHS
8x10 colour photo of A-O-7 over the
earth \$3.00pp(20IRC's). WB4VXP
Alan Bridges, 4520 Bull Run NE,
Kennesaw, GA., 30144; please make
the cheque out to AMSAT.

After four and a half years of valiant service, the AMSAT-OSCAR 6 spacecraft appears to have reached the end of its useful life. It is worth noting that the spacecraft carries a plaque dedicated to the memory of Harry Helfrich (the original W3ZM) who was one of the original directors of AMSAT.

ARTICLES

You too can be published in this magazine. If you have developed something useful, why not share it with the rest of us. The Newsletter rarely turns down an offering. Manuscripts do not have to be typed; clear handwriting (double spaced) will do. One article lay in the pile (at times it was the pile) for a year or so, because not only was it hand written but it was very closely spaced and without paragraphs. Each time I picked it up, I looked at page one and put it down again. Finally a publication deadline came when material was lacking, and I had to force myself to read that article. Would you believe it was pretty good? It would have been published much earlier had it been readable. One good reason for publishing in the Newsletter is that you can publish a first draught in these pages, get comments from members, polish it up and submit an expanded, polished version of the article to one of the national magazines, who pay for material.

The Newsletter contains material submitted by the members of AMSAT. I try to put everything on hand into each issue, thus the fluctuating size of the Newsletter. Do your bit to make each issue of the Newsletter a giant economy package.

COMPUTERS

Amateur radio is becoming computerized. The price of home computers is dropping, and amateur radio is a natural application. Morse code, RTTY and logging are ideal applications for computerizing. A down to earth application of the computer is to track a satellite in the sky. Antenna pointing and orbital predictions are tasks easily performed by the computer. This issue of the Newsletter carries an introductory article describing cost effective home computer hardware and software designed for AMSAT applications as well as general purpose home computing. Now the AMSAT Newsletter is not a computer club magazine, so the depth of coverage of the design must depend on the member response. The format of Part II of the article will depend on your response. If you are interested in the AMSAT-80 Computer, send in a QSL card saying so. If you are not interested, send one in saying so. An arbitrary minimum of 100 cards has been set as an indicator of sufficient interest in the project.

VOTE

This issue contains the ballot form for the elections to the Board of Directors. A contested election is an indication of an active organization, and all AMSAT's elections have been contested. Your vote counts. Be sure to mail one in if you do not plan to attend the general meeting.

MEMBERSHIP RENEWALS

This issue contains your membership renewal notice. If you are not a life member, don't forget to mail in dues as soon as possible.

SAVE SOME MONEY

Why not save some money and send your ballot, your membership renewal, solar cell sponsorships and comments on the AMSAT-80 in the same package. If you feel energetic, add a letter to the editor or an article to the bundle. Looking forward to hearing from you.

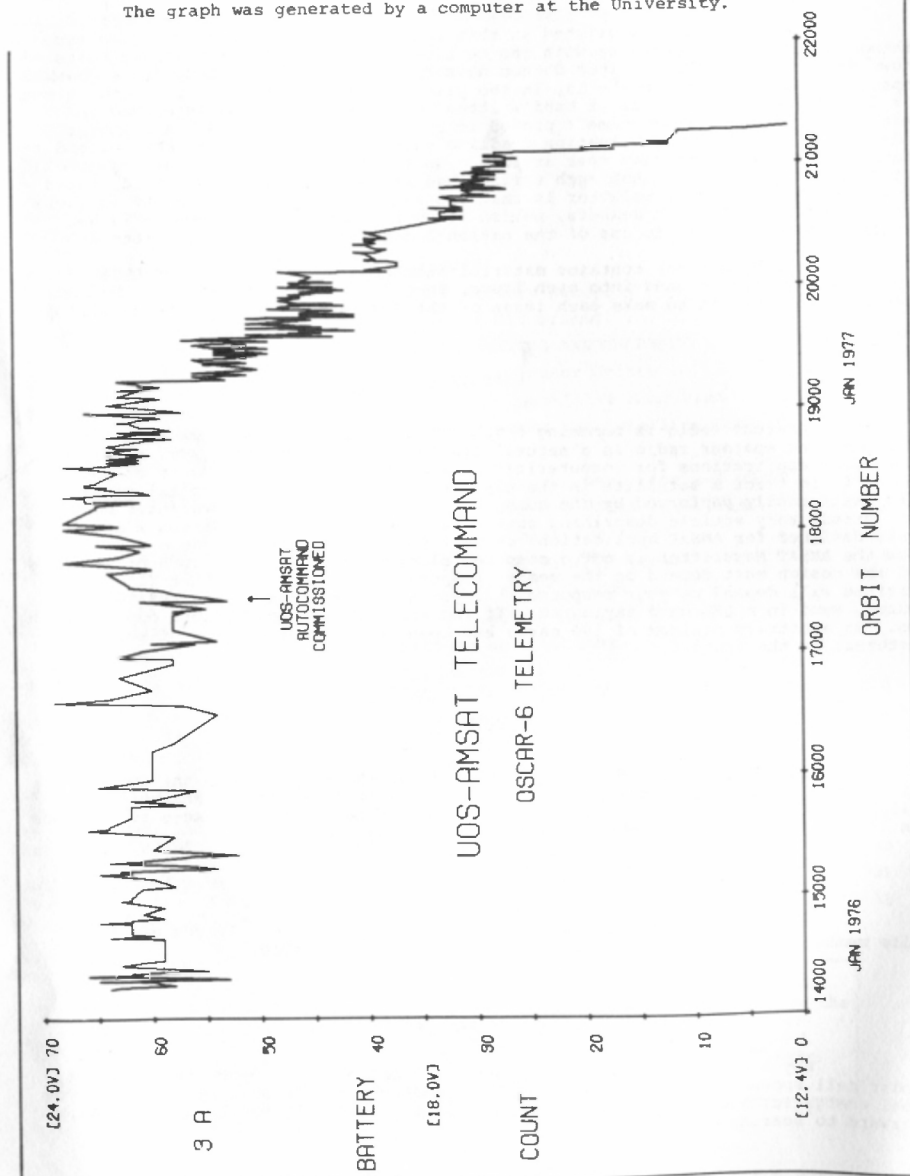
Joe G3ZCZ

AMSAT-OSCAR 6 BATTERY DECAY

The graph shown below clearly illustrates the failure of the AMSAT-OSCAR 6 spacecraft battery. This graph compiled at the University of Surrey (site of the British Command Station) shows how the battery voltage (over Europe) improved when the Command Station was commissioned.

As each cell failed a distinct step can be seen in the curve until finally the failure came so fast that a near vertical curve resulted.

The graph was generated by a computer at the University.



FAREWELL OLD FRIEND

BY JOHN FOX, WØLER

The batteries on the AMSAT-OSCAR 6 have been slowly degrading since January 1, 1977. On June 15, 1977, AMSAT-OSCAR 6 failed to respond to ground command and remained in an "On Mode" until orbit 21405 when the beacon ceased transmitting shortly after acquisition in Minneapolis, Minnesota.

AMSAT-OSCAR 6 was launched aboard a Thor-Delta rocket from Vandenburg Air Force Base in California, U.S.A. on October 15, 1972. AMSAT-OSCAR 6 was an international venture by Amateurs in Australia, Canada, Germany and the United States.

The list of accomplishments by the AMSAT-OSCAR 6 spacecraft are many. The following is a partial list of some of the more publicized accomplishments:

- First Amateur Communications Satellite capable of responding to telemetered commands.
- First Amateur Satellite with dual frequency beacons of 29.45 MHz and 435 MHz.
- First long life Amateur Satellite with regular two-way communication capability.
- The use of Codestore for the automatic retransmission of a telemetered message.
- Used by many U.S. educational institutions for classroom instruction.
- Used in the development of a downed-aircraft emergency location system (ELT) in a joint venture between the Canadian and United States Governments.
- Discovery of the Inverted Doppler propagation mode using the 435 MHz beacon.
- Used in numerous tests involving transmission of medical data between medical institutions and field mobile to medical institutions.
- Numerous propagation experiments.
- Allowed regular communication between all continents involving over 100 countries.
- First Inter-Satellite communication involving AMSAT-OSCAR 6 and AMSAT-OSCAR 7.
- First transmission of meteorological data using 110 baud ASCII from a remote platform.

The design lifetime of AMSAT-OSCAR 6 was one year with the actual lifetime being 56 months. The long life of AMSAT-OSCAR 6 is directly related to the excellent and efficient operation of the command stations. Without the dedication of the members of the International Command Network, AMSAT-OSCAR 6 would have failed after only a few months of operation.

To all of you involved in the commanding and operation of AMSAT-OSCAR-6 a sincere Thank You from the Amateurs of the World.

With the end of the usefulness of AMSAT-OSCAR 6 another proud entry goes into the annals of Amateur Radio history. It will be missed by all the satellite users but time marches on and the future looks bright for the Amateur Satellite program. We still have an excellent functional satellite in orbit, AMSAT-OSCAR 7; The planned launch of a Russian Amateur Satellite in the near future; the launch of AOD in early 1978 and the launch of the first Phase III satellite in late 1979.

Congratulations to AMSAT, the International Command Network and the users of AMSAT-OSCAR 6 on a very successful program. And last but not least Thank You to AMSAT-OSCAR 6 for thousands of hours of enjoyment. "Farewell Old Friend".

ANNOUNCEMENT OF AMSAT ANNUAL MEETING

The ninth AMSAT Annual Meeting will be held at 8:00 P.M. on Saturday, October 8, 1977, at the NASA Goddard Space Flight Center Employee Recreation Center in Greenbelt, Maryland.

In accordance with the AMSAT Bylaws, ballots for the election of four Directors and two alternate Directors will be counted at this meeting. The terms of the following Directors will be expiring as of this meeting: Charles Dorian, W3JFT; Jan King, W3GEY; Perry Klein, W3PK; and William Tynan, W3XO/W3KMV.

The agenda, in addition to the election and regular business, will include:

- AMSAT Annual Report
- AMSAT-OSCAR-D Project
- AMSAT Phase III Progress Report
- AMSAT-OSCAR 6 and 7 Operations
- Results of election of Directors

As we did last year, there will be an AMSAT Technical Symposium on OSCAR satellites, beginning at 3:00 P.M., organized by Marty Davidoff, K2UBC/3.

For those coming from out of town, let us know, and we will arrange for you to be hosted by Washington area AMSAT members.

DIRECTIONS TO THE NASA GODDARD EMPLOYEE RECREATION CENTER:

Take the Baltimore-Washington Parkway to the Greenbelt Road exit (Rt. 193), and take Greenbelt Road east 1.5 miles to Soil Conservation Road (on the left). Turn left onto Soil Conservation Road and go 0.1 mile to the first open gate you come to on the right. Go through this gate, continue onto the gravel road and then on to the wooden Goddard Recreation Center building.

There will be an AMSAT dinner before the meeting at 6:00 P.M. at the Goddard Employee Recreation Center. Please let us know if you can join us so that we can firm up reservations.

The 146.25/85 AMSAT repeater will be available for talk-in before the dinner and the meeting.

AREA CO-ORDINATOR UPDATE

Please note the following additions/changes to the published listing of Area Co-ordinators.

OVERSEAS

Czechoslovakia	Andrej Oravec, OK3CDI, ul. Slobody 31, 040 11 Košice 11.
India	Wg-Cmdr. V. Subramanian, VU2UV, L.R.D.E. High Grounds, Bangalore-1, PIN 560001.
Zambia	Kanubhai Patel, 9J2KL, P.O. Box 233, Lusaka.

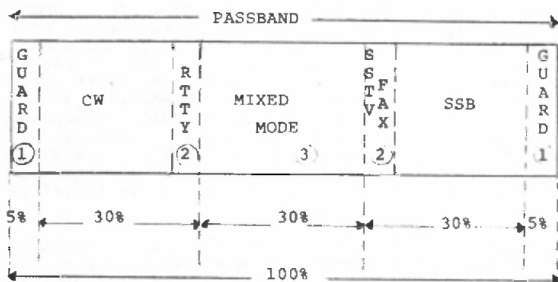
U.S.A.

Illinois (South)	Larry H. Roberts, W9MXC, 3300 Fernwood, Alton, IL 62002.
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A PROPOSED SATELLITE BAND PLAN

BY JOE KASSER, G3ZCZ

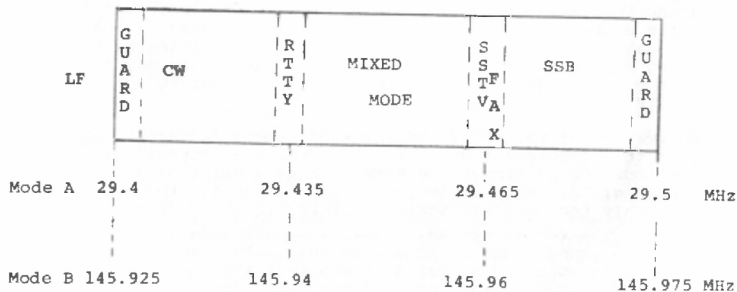
A new band plan has been proposed for application to all satellites and all transponders, and is published here for user comments. If adopted, this plan would follow the observed use of the satellites over Europe and is based on the downlink passband as follows:



- NOTES: 1. Guard Band to avoid interference to beacons, to be used only by Emergency and Bulletin Stations.
2. RTTY and SSTV/FAX are put at edge of CW or SSB bands conforming to their mixed mode usage at HF.
3. Mixed mode area, recommended for use by crystal controlled stations and dx-peditions wishing to work both CW and SSB stations.

Splitting the passbands into CW and SSB are traditional. The edges of the sub-bands merge into the mixed mode area and are flexible so that occupancy can expand from the band edge past the RTTY/SSTV/FAX area depending on the number of communicators using the satellite at any time.

This bandplan is based on percentages of the passband. It is based on the downlink passband and applies to both inverting and non-inverting passband transponders. Thus on AMSAT-OSCAR 7 the frequency sub-bands are as follows:



- NOTE: Mode A Guard Channels, 5 kHz
- Mode B Guard Channels, 2.5 kHz

It is expected that on Mode B, the SSB sub band would spill over into the mixed mode more than on Mode A simply because of the large number of communicators in the 'small' passband.

Please send your comments on this proposed band plan to AMSAT, C/O Joe Kasser, G3ZCZ.

BASIC ANTENNAS FOR OSCAR SATELLITE COMMUNICATIONS

BY DAVE CLINGERMAN, W6OAL

This article presents three basic types of antennas and the derivation of each. Since the launch of the AMSAT-OSCAR 6 spacecraft the author has, at one time or another, tried every type of antenna imaginable, for satellite communications, from a coat hanger ground plane to a log periodic helix. During this five year period of experimentation the various antenna configurations have been used to set such world records as, first aeronautical mobile amateur satellite communication including an airborne satellite command station over the Pacific Ocean. This was accomplished using a bent brass rod ground plane. The first maritime mobile, transcontinental amateur satellite contact was conducted using a "J" antenna for uplink and a dipole for downlink. The first automobile-in-motion amateur satellite TransPacific contact was completed using a "J" on one side of the vehicle for uplink and a Webster Band Spanner mobile antenna on the other side. The claimed longest distance contact via amateur satellite, 9,264 km, Kwajalein, Marshall Islands to Tacoma, Washington was completed using a ground plane and longwire on the South Pacific end of the contact. In the setting of all these records low power was used, (below ten watts), so "brute force" is not the name of the game.

A ground plane antenna (GP) can be built onto a female coaxial fitting, a BNC, N, and SO-239 being most common. This allows a coaxial feed, a great convenience. If you're a stickler for low VSWR and good impedance matching, droop the radials to about 42° out of the horizontal. This increases the impedance from the normal GP, 36 ohms to approximately 50 ohms. This type of antenna can be used for both uplink and downlink. It is a fixed frequency device and an SWR approaching 2:1 will be noticed at operation $\pm 10\%$ of the frequency for which it was constructed. GP's are noted for their low angle of radiation and that is where you want to put your power, toward the horizons. The "cone of silence" mentioned in various texts occurring directly above a GP may not be noticed due to the very high sensitivity exhibited by the OSCAR series spacecraft receivers. The GP can be mounted almost anywhere without difficulty, preferably above existing structures: an outrigger from the existing ham tower; a pole stuck in the back yard; a fence post; the eaves of the house to mention a few.

From two meters, up in frequency or down in wavelength, the GP's are not very visible, especially if painted sky-blue. I make this point in case the intended operation is to be in a neighborhood of grouches or if an apartment type of operation.

Building the GP involves a minimum of material. Brazing rod is the author's mainstay for such projects. Plane copper wire will work, however flimsy. For a ten meter GP, a modified CB antenna will work great plus they are already of proven design and inexpensive. Used ones are readily available for little or nothing. For the higher frequencies, as previously mentioned, a coax fitting can be used for the hub. Then radials, at least four, can be soldered to the fitting and the radiating element to the center conductor. The plane may also be made of a circular sheet of aluminum or formed into a cone in order to achieve the degree of matching desired.

A derivation of the GP is the 5/8 wave-length radiator. Several advantages are available in this configuration. The first being an approximate 1.8 dB gain over the conventional GP or almost the same gain as a vertical dipole. Secondly, a slightly lower angle of radiation which is the reason for the increased gain; thirdly, and possibly the most attractive feature, is the radiating element may be affixed directly to the radial system, plane or mounting device. Part of the radiating element is wound into a three turn coil. The center conductor of the coax is tapped to this coil and soldered in place at the point where the lowest obtainable vswr is measured on the intended frequency of operation. Brass or copper rod/tubing will work well in this application. Steel rod is hard to work with and equally difficult to solder to. With a little torch work, stainless steel can be used and would weather the best. To keep weather out of the coax, tin the braid before affixing it to the counterpoise and saturate the open end with Glyptal or seal it with Selsastic Rubber. The 5/8 wavelength antenna may also be built on a female bulkhead coax fitting if desired.

The dipole antenna is a center fed half wavelength radiator. Its characteristic impedance is 72 ohms. It is generally utilized in a horizontal configuration, some applications may necessitate its vertical usage. Horizontally it is a bidirectional radiator; vertically it's omni-directional with a low radiation

angle. The dipole when used in the HF region and constructed of wire requires two structures for support. Vertically it may be mounted to a single structure preferably wooden or other nonmetallic material in order to reduce pattern distortion. Coax feed is the normally applied method, but 72 ohm ribbon is available from Beldon Cable Company. In the application of a folded dipole, 300 ohm TV twinlead is readily available and inexpensive.

A dipole may be constructed of wire, tubing, brazing rod, flat stock, whatever may be available. In the category of VHF/UHF dipoles, construction may be on, again, a coax fitting. Baluns may be added, but for the sake of simplicity are not required.

Mounting a dipole $.2 - .25$ wavelength above a sheet of aluminum that, on a side, is 5% greater than the length of the dipole yields a system of 3 dB more gain than a dipole by itself, and becomes unidirectional. This configuration makes it a handy, portable antenna for 2 meters or 70 cm. It does not have quite the aperture (capture area) required for very weak signal reception but for OSCAR work it performs quite well.

A derivation of the dipole antenna is the "Turnstile". This comprises two dipoles perpendicular to each other and fed through a $1/4$ wave coaxial balun. The result is a cloverleaf pattern effectively doubling the aperture and enhancing the propagational properties. The "Turnstile" may also be mounted above a reflector as previously mentioned with the dipole. The dipole configurations exhibit a slightly greater tolerance to frequency excursions than the GP. The order of $\pm 12-15\%$ should not raise the VSWR over 2:1 especially at 145 MHz and above. Unless the VSWR is extremely high, it won't be all that noticeable because of the feed line loss. The best policy is to cut the dipoles for the frequency to be most used and don't worry about occasional frequency and accompanying VSWR excursions.

At this point I'd like to introduce a frequency independent antenna, the Discone. The main advantage of this type of antenna for satellite communications is it may be used for uplinking on one band and downlinking on another. An 8:1 frequency range with the VSWR remaining below 1.5:1 can certainly be appreciated by those of us that don't have a great deal of room for varied multiple arrays. The Discone is fix mounted with ease and simplicity incorporating a small diameter center pole. It is omni-directional and vertically polarized. The feed-point arrangement is such that 50 ohm coax is used. The material needed in the construction of this antenna requires nothing fancy. Brazing rod and hardware cloth (copper screen) plus a suitable insulating material, preferably Teflon, is all that need be used. Such a large frequency range doesn't require the crowding at the bottom end of the design band. In most cases this antenna will be built for 2 meters as the bottom band. A rule of thumb is to drop the design frequency 20% below the lowest frequency you intend to use. Even to use 100 MHz as the design frequency allows the coverage of three ham bands, two of them common to the present OSCAR series. The space required for this antenna is less than two cubic feet. This still isn't too large to be used on an apartment dweller's balcony.

Construction details are not the subject of this article; however, dimensions are available in Bill Orr's Radio Handbook and Henry Jasik's Antenna Engineering Handbook.

Last but not least, let's look at the Yagi antenna for satellite operation. The Yagi is narrow-banded but a derivation of the Yagi, the "Log Periodic", which I will discuss later, is frequency independent. Similar in band-width to the Discone, the Yagi is unidirectional having a front to back ratio of 15-25 dB depending on the number of elements and their spacing. As a basic antenna let's consider a three element Yagi on 2 meters. The boom is approximately 2 feet long. The longest element (reflector) is approximately 40 inches. A gain of 4.5 dB is obtainable over a dipole. It would require a little over 2 feet for turning radius. A light weight TV rotor would be adequate. For best results a fixed tilt angle of 30° is suggested unless elevation control is contemplated. The boom can be wood or metal, the elements aluminum tubing, but stiff clothes line wire will work fine. A variety of matching systems may be used. This is left to the constructor's preference. Myself, I'd use a matching system that allows the use of coax for the sake of simplicity.

As we progress higher in frequency, the Yagi becomes smaller allowing us to add more elements and still conserve space. A word of caution--the more elements, the longer the boom, the sharper the beamwidth, lots of time spent in repositioning (manual tracking), i.e., reduced operating time. In the embryo stages of your satellite communicating, the emphasis should be on operating, not pin-point tracking.

(Continued on page 23)

R-S OSCAR

AMSAT has received Circular No. 1273 dated July 12, 1977, from the International Telecommunication Union's International Frequency Registration Board giving advance information on a planned amateur satellite network by the U.S.S.R. A summary of the information is presented below:

General Information: "The U.S.S.R. Administration wishes to inform members of the I.T.U. that the U.S.S.R. is working on the establishment of an amateur-satellite service system. This system "RS" will be based on 3-4 satellites in a circular near-polar orbit. The amateur satellites are designed for multiple access with retransmission and frequency translation without demodulation on a real time scale."

Date of Activation: 1977-1978

Number of Satellites: 3-4

Orbital Information: Inclination, 82°
Altitude, 950 km (circular orbit)
Period, 102 minutes

Uplink Characteristics: 145.8-145.9 MHz (100 kHz bandwidth)
quarter-wave receiving antenna, circularly polarized.
User uplink power, 10-15 watts to 10-12 dB antenna.
transponder receiver noise temperature, 3000° K.

Downlink Characteristics: 29.3-29.4 MHz (100 kHz bandwidth)
half-wave transmitting antenna, circularly polarized
transponder power, 1.5 watts peak to 0 dB gain ant.

Maximum Ground Communications Range: 6,000 km (3,720 st. mi.)

From this advance publication orbital information, it seems likely that the "RS-OSCARs" will be launched piggyback with the Meteor meteorological satellites from the Plesetsk launch site.

AMSAT welcomes this new series of Soviet amateur radio satellites in the spirit of international friendship and cooperation.

POTENTIAL LAUNCH DATES

BY WILL WEBSTER, WB2TNC

The notice submitted by the USSR to the International Frequency Registration Board of the ITU does not nail down the launch date for the first RS OSCAR any closer than "1977-1978". It is, in fact, not normal practice in these notices to be any more specific than that. We can, however, make some educated guesses as to when the Soviets are likely to launch.

From the orbital characteristics, the RS OSCARs will probably be launched piggyback with the USSR meteorological satellites called Meteor. The standard launch vehicle used for the Meteor series has plenty of reserve capability. Weight of the RS OSCAR should not be a problem in getting a launch.

At present, the USSR is launching about 8 to 10 payloads into orbit a month. Of these, about half are going into the Meteor type orbit. Not all of these are meteorological payloads of course. Most are Cosmos scientific satellites and other payloads. Thus, the availability of a ride won't be much of a problem.

It is not the policy of the government of the USSR to give out the exact launch date unless an international agreement requires it. The ITU convention does not require notification before the fact.

However, there are two important anniversaries coming up. October 4, 1977, is the 20th anniversary of the launching of Sputnik I, the first artificial earth satellite. Also, depending on which calendar one uses, the 60th anniversary of the Russian Revolution takes place on October 15 or 17, 1977. The best guess is that the Russians will try to launch on one of these dates.

We are not likely to get any warning, so be prepared. If you should hear a beacon, carefully determine its frequency and try to measure the doppler shift. If all you get is your transponded signal, carefully look for doppler shift. Check again much later to be sure you aren't being led astray by an image in your receiver.

TRACKING THE RS-OSCAR SATELLITES

As an aid to tracking the RS-OSCAR satellites Will Webster, WB2TNC, generated the following ground track tables. The table on the back page of the W6PAJ orbit book should be modified by the RS-OSCAR data listed below. The OSCAR 7 data is given as a reference check for your computations.

STATION LATITUDE (degrees)	OSCAR 7		RS-OSCAR	
	LONGITUDE CORRECTION (degrees)	TIME CORRECTION (min:sec)	LONGITUDE CORRECTION (degrees)	TIME CORRECTION (min:sec)
70° N	-40.4	+23:26	-14.5	20:8
60° N	-29.5	+19:46	- 7.9	17:8
50° N	-18.3	+16:21	- 4.5	14:8
40° N	-13.2	+13:01	- 3.0	11:8
30° N	- 9.3	+ 9:44	- 1.9	8:8
20° N	- 5.9	+ 6:28	- 1.1	5:9
10° N	- 2.9	+ 3:14	- 0.5	2:9
0°	0	0	0	0
10° S	+ 2.9	- 3:14	+ 0.5	- 2:9
20° S	+ 5.9	- 6:28	+ 1.1	- 5:9
30° S	+ 9.3	- 9:44	+ 1.9	- 8:8
40° S	+13.2	-13:01	+ 3.0	-11:8
50° S	+18.3	-16:21	+ 4.5	-14:8
60° S	+25.9	-19:46	+ 7.9	-17:8
70° S	+40.4	-23:26	+14.5	-20:8

Convention: Add (algebraically) longitude correction to WEST longitude of Equator crossing.

These stickers are printed in black on a fluorescent red background. They are pressure sensitive and will stick to anything including QSL cards and envelopes.



AMSAT

They come in sheets of 48 and may be obtained from David Middleton, W7ZC, Box 303, Springdale, Utah 84767, for only \$1.25 postpaid.

A SILVER JUBILEE MESSAGE

BY RICHARD LIMEBEAR, G3RWL

During Sunday the 5th of June, AMSAT-OSCAR 7 continuously transmitted a Jubilee message in Morse code over the Codestore message storage system. The text of the message read, "AMSAT sends greetings to the United Kingdom on the occasion of The Queen's Jubilee." This message, intended as a tribute from the amateur radio fraternity, was repeated more than 1,000 times as the satellite passed over every single country in the world, and was received by thousands of the world's radio amateurs.

THE FOLLOWING LETTER WAS RECEIVED BY AMSAT-UK:



BUCKINGHAM PALACE

29th July, 1977

Dear Mr. Limebear,

Thank you for your letter of 14th July which has been shown to The Queen.

Her Majesty learned with interest of the Jubilee message transmitted by the amateur radio satellite, Oscar-7, and greatly appreciated the greetings to the United Kingdom sent by Amsat to mark her Silver Jubilee.

Yours sincerely,

A handwritten signature in dark ink, appearing to read "W.L. Limebear", with a horizontal line drawn underneath it.

Richard W.L. Limebear Esq.,
Communications Officer,
Amsat - UK

THE AMSAT-80

© BY JOE KASSER, G3ZCZ

PART 1

INTRODUCTION

Microcomputers are getting cheaper and are useful for satellite applications in the ham shack. Their usefulness in producing satellite orbit predictions, antenna pointing data and telemetry processing is well known. Thus, the AMSAT-80 Project for an 8080 or Z80 based S-100 Bus Microcomputer for tracking OSCAR 7, Phase III, amateur radio and other general uses. The AMSAT-80 is designed to be low cost, multipurpose and capable of using most any S-100 based hardware. AMSAT has also arranged a group purchase of hardware to keep the cost down. Software as well as hardware will be available, again designed for modularity and inter-compatibility.

The hardware features of the design include the following:

- a. a BOOTSTRAP feature, allowing RAM in low memory and ROM in upper memory without the requirement for a complex front panel, and
- b. the generation of the MEMW signal, not performed on most commercial printed circuit CPU cards.

The Software features include a full debug program, applications packages and high level languages, all inter-compatible. Input/Output handlers for many categories of devices such as baudot/ASCII teletypes, audio cassettes, floppy discs, video display boards and paper tape devices. The software will be available for basically a reproduction cost. It is planned to publish full details in a computerist magazine and make object or source tapes available. In this way, AMSAT gets the exposure; the documentation is complete, and the cost of distribution is lowered. Periodic announcements will be made in the pages of the Newsletter as to the status of the project. At the time of writing this article each item of software announced is at least 75% completed (excluding documentation). No software will be released until it is 100% tested and documented, so don't write in and ask for it; wait for the announcement.

The AMSAT Newsletter is not a computer magazine, even though the next generation of spacecraft will incorporate them both in orbit and on the ground for telemetry, tracking and command purposes. Thus, if you, the reader, wish to see the AMSAT-80 project described herein in more detail, send in a QSL (with or without your order for hardware). An arbitrary minimum of 100 cards has been set as a level of interest indicator sufficient to allow the publication of details. Otherwise, only broad outlines will be published. On the other hand, if you do not wish to see the AMSAT Newsletter full of computer articles, write in and say so.

In order to obtain some of the cost advantages of mass produced hardware, the optional software will be available prelocated in memory. After extensive research Tom Clark, WA3LND, came up with the memory usage map shown in Table 1. Note that the low memory is RAM, for multiple program usage, and the debug package -- I/O handlers (AMS-80) resides in PROM in Upper memory. Other software can reside anywhere.

SOFTWARE

The optional software available will include the following:

AMS-80 (version 5) An extensive debugging package containing I/O handlers and utility subroutines. Functions performed include memory/register examine and change; symbolic disassembly; Intel hex format object code reading and writing; ASCII dump of memory; hex dumps of memory; utility routines include I/O handlers for teletypes; keyboards, graphics on VCM board; baudot to ascii conversion for RTTY; hex to ASCII; ASCII to hex; ASCII text input and output. A terminal mode of operation is also present.

AMSAT STANDARD ----- 9080/280 MEMORY ASSIGNMENTS

MEMORY RANGE	TYPE	FUNCTION
0000 - 000A	RAM	REQUIRED FOR AMS80 MONITOR LINKAGES
000B - 9FFF	RAM	USER RAM AREA. < SEE NOTE BELOW >
		SUGGESTED ALLOCATIONS:
000B - 004F	RAM	LEAVE FOR HANDLING INTERRUPTS
0050 - 1FFF	RAM	PROGRAM/STORAGE AREA. THIS AREA WILL HOLD MOST BASIC INTERPRETERS, EDITORS, ASSEMBLERS AND UTILITY PROGRAMS.
2000 - 29FF	RAM	NORTH STAR MICRO-FLOPPY D.O.S. AREA *
2A00 - 52FF	RAM	NORTH STAR MICRO-FLOPPY BASIC AREA *
5300 - 6FFF	RAM	PROGRAM/STORAGE AREA
7000 - 7FFF	RAM	DICK ALLEN FLOATING-POINT MATH PACK *
8000 - 9FFF	RAM	PROGRAM/STORAGE AREA
A000 - BFFF	ROM	RESERVED 16K AREA FOR USER EPROM'S *
C000 - CBFF	ROM	RESERVED FOR CASSETTE TAPE INTERFACES.
	OR	THIS AREA IS USED BY NATIONAL MULTIPLEX
	RAM	AND PROCESSOR TECH'S SOL SOFTWARE. *
CC00 - CFFF	RAM	RESERVED 1K BLOCK FOR VIDEO RAM. THIS MATCHES PROC. TECH.'S SOL AND AMS80 DEFINITION. *
D000 - E7FF	RAM	OPTIONAL USER RAM AREA
E800 - EFFF	DISK	RESERVED FOR NORTH STAR MICRO-FLOPPY DISK I/O AND BOOTSTRAP LOADER. *
F000 - FAFF	ROM	AMSAT AMS80 MONITOR/OPERATING SYSTEM
FB00 - FCFF	ROM	OPTIONAL ROM AREA FOR AMS80 EXPANSION
FD00 - FDFD	ROM	VIDEO MONITOR OUTPUT DRIVER *
FE00 - FEFF	ROM	VIDEO GRAPHICS DRIVER AND LINKAGES FOR GRAPHICS/UTILITIES FROM BASIC. *
FF00 - FFFF	FREE	USER ROM/RAM OR MEMORY-MAPPED I/O AREA

* DENOTES OPTIONAL HARDWARE/SOFTWARE MEMORY REQUIREMENTS

NOTE: AMS80 initializes its stack and buffer area at the "top" of user RAM automatically. It does this by reserving the "top" 256 bytes of RAM it finds. The user may specify the definition of "top" to protect portions of RAM from being appropriated by the system. The Video RAM from CC00-CFFF should be so protected to avoid AMS80 from allocating it to the stack/buffer area.

TABLE 1. Memory Map

This is an expanded version of the earlier monitor package/operating system published in the September 1976 issue of "Byte" magazine. All I/O to the software is on a character basis (<A> in, or <C> out) and thus is I/O device independent. The I/O handlers take care of any "blocking" required. I/O is assignable in software with certain restrictions and can even be changed within a program. (85% completed)

- MATH A full floating point math package: includes scientific and trigonometric functions. Works to seven (7) significant digits. (All I/O via AMS-80) (90% completed)
- FPI Floating Point Interpreter, allows floating point instructions to be written using a floating point accumulator. Adds a tiny overhead to execution time but saves a lot of programming grief. (All I/O via AMS-80 and MATH) (Originally developed by Richard Allen, W5SXD) (75% completed)
- TRACK Real time Tracking Program for AMSAT-OSCAR 7. Shows position of spacecraft with reference to your QTH (az-el) in real or speeded up time and doppler. (Requires VDM board Real Time Clock and FPI) (Originally developed by Richard Allen, W5SXD) (75% completed)
- BASIC Patches for Livermore Basic, MITS 8K Basic (version 3.0) and Processor Technology 5K Basic to interface to AMS-80 will be available. Note that only patches to proprietary software will be available and not the original software. (80% completed)

- ORBIT Assembly language program listing orbital crossing times for the AMSAT-OSCAR 6 and 7 spacecraft. Options include, REference, ALL, ASCending, DESCending and LOCAL orbits. (All I/O via AMS-80). Developed by Joe Kasser G3ZCZ, 95% completed. Used to generate orbit listings published in AMSAT Newsletter.
- LOG Contest logging program, keeps checksheet in memory and dumps log to high speed output device. (All I/O via AMS-80) (Assembly language, developed by Joe Kasser, G3ZCZ) (80% completed)

POWER SUPPLY AND MECHANICAL DESIGN

This is up to each and everyone. The Power Supply should deliver between 8 and 10 V at 15-20 Amps, as well as both +16 to 18 V and -16 to 18 V at 2 Amps each. It does not need to be stabilized. It is recommended that the front panel include a RESET and BOOT switch as a minimum.

Optional (and recommended) extras include an I/O port (address OFF Hex) and a HALT light.

Further extras include full data and address bus switches and displays for hardware trouble shooting.

Components are available from many suppliers.

HARDWARE

Any S-100 bus hardware is suitable, providing that the addressing of areas of memory is compatible to the one shown in this article. AMSAT has arranged a group purchase of Cybercom or Solid State Music cards (advertized in your favorite home computer magazine) in the following categories (kits only), as a service to members.

- 4K RAM Board - contains 4K of 21L02 type RAMS. (450 ns)
- 8K RAM Board - contains 8K of 21L02 type RAMS. (450 ns)
- 16K RAM Board - contains 16K of static RAM. (200 ns)
- 4K PROM Board - contains 4K of 1702A type PROMS. (2 wait states)
- 8K PROM Board - contains 8K of 2708 type PROMS.
- IO-2 Board - contains one input and one output port in PC form with address decoding for seven more. Schematics are given for adding serial I/O port with various communications baud rates (45.5 to 110) for USARTS giving RTTY capability. Schematics for the front panel features such as Reset, Boot, and I/O port and a keyboard interface port schematic are also available.
- Video Display Board (VDM) - displays 16 lines of either 64 or 32 characters. Full graphics capability on a 128 x 48 matrix (dots) or reverse video options available (with software driver package).
- Mother Board - a 15 position single sided mother board. IMSAI (either PC or wirewrap) edge connectors fit. At least one wirewrap connector is recommended for ease in trouble shooting.
- Extender Board - eases trouble shooting by allowing a board to be lifted above the others in the chassis. Requires a PC type edge connector on the top to complete the socket for the card being tested.

Additional hardware may become available in time.

The recommended CPU card (for cost purposes only) is the Byte Shop Special (8080 + PC for about \$30.00), available from any Byte shop in the USA. This card also contains a programmable interrupt circuit (8214 IC).

THE FRONT PANEL

The front panel is the visual interface to the outside world. It is the part that non-technical people see when they first gaze upon your machine (with wonder?). It can be as complex or as simple as you wish it to be. Circuits have been developed that let you put a large number of features on your panel, each one independent of the others and fortunately none are mutually exclusive.

The following features are available:

1. RESET SWITCH

This is a must. It causes the 8080 to begin execution at location 0.

2. BOOT SWITCH

This is also a must in the AMSAT-80 design. It causes the 8080 to begin execution at address location F000 (Hex) (the base address of AMS-80). When you are in RAM, hitting the Boot Switch will put you in AMS-80 even if you are in low memory. It requires eight (8) IC's and works by grabbing the data bus on the CPU card and forcing No-ops until address 0F000 (Hex) is reached, then returning control to the 8080 to continue execution in AMS-80.

3. MEMW GENERATOR

This simple circuit is another must. The CPU card does not generate the MEMW signal; thus circuitry must be provided to generate it. Alternatively, you can patch the Byte Store Special CPU Card to generate the signal if you really want too. Both schematics will be available.

4. I/O PORTS

An I/O Port is desirable but not necessary. It can be used to blink lights or test status under program control. They are useful during program debugging and for setting up custom overrides to particular software if structured that way.

5. ADDRESS BUS DISPLAYS

An optional feature of having the contents of the address bus displayed all the time is useful (provided it is not a binary display) because loops in the program can be determined visually and instantly. The displays can be in either Hex, Octal or Binary.

6. CPU STATUS DISPLAYS

The status lines such as HALT, READ and WRITE can be used to drive Front Panel LED's. These features are optional, but HALT and INTE lights are recommended.

7. SINGLE STEP

A single step feature is optional. This can be used in conjunction with the address bus and status displays to manually follow through the steps of a program.

8. DEBUGGING CIRCUITRY

An optional extra is full hardware debug capability allowing memory to be read and changed from the front panel. In this mode the CPU is halted and the front panel takes control of the bus. This feature is only really useful when first bringing a system up, or in a unit designed to checkout S-100 hardware. It is recommended that each group of people building an AMSAT-80 have at least one of these cards.

NOTES: At present a printed circuit card is not available. The necessary circuits can be wired on an IO-2 board, leaving space for a keyboard interface (to go with the video display board).

Table 2. Serial Interface

<u>Pin</u>	<u>Signal</u>	<u>Pin</u>	<u>Signal</u>
1	Chassis Ground	17	20 mA Current loop (+) Terminal to Computer
2	EIA data from Terminal to Computer	23	20 mA Current loop (+) Computer to Terminal
3	EIA data from Computer to Terminal	24	20 mA Current loop (-) Terminal to Computer
7	Signal Return	25	20 mA Current loop (-) Computer to Terminal
10	+18 V Supply		
13	-18 V Supply	4,5,6, 8,11,12	Modem handshake signals

INTERFACE STANDARDS

Interfaces come in two types namely serial and parallel. A standard is desirable to enable several individuals to get together and combine equipment to build a system greater than the sum of the individual parts, like at demonstrations or club meetings. Thus, the following standards (which are already in existence) are suggested:

1. Audio signals - Audio signals to/from cassette recorders via phono connectors. Phono plugs/sockets are cheap and widely available.
2. RF/Video Signals - BNC RF connectors should be used. The BNC type of connection is used in amateur equipment and is readily available throughout the world.
3. Digital Signals -

a) Serial Data - Serial Data Interfaces will be via a 25 pin EIA {mark = {-3 V to -12 V}, space = {+5 to +12 V}} connector. The pin assignments are based on the RS-232 standard as shown in Table 2.

b) Parallel Data - Parallel Data Interfaces will also use the same type of connector. Each connector will carry one 8 bit input port, one 8 bit output port and a set of handshaking control/status signals. The signal pin connections are shown in Table 3 and are compatible to the MITS System pin outs.

The chassis connector on the computer will be female; the chassis connector on the remote device will be male for the following reasons:

- a. Power may be fed from computer to remote device via that cable. Having a female connection on the "hot" lead reduces the probability of short circuits.
- b. Cables can be joined together to make longer ones without needing any special adapters.

COMING IN PART II:

In Part II there will be details of the "front panel" circuits. The circuitry is modular so that any or all parts may be incorporated in your system. The use of AMS-80 will also be described and a status report on software development will be given. Anyone who already has an S-100 bus system running and is interested in helping in the project development, please contact me at the Editorial address listed on page 2. A specific requirement at this time is the development and interfacing of a software package to drive an audio cassette recorder with blocks of data and start and stop of recorder so that the tape can be stopped while data is processed.

Table 3. Parallel Interface

<u>Pin</u>	<u>Signal</u>	<u>Pin</u>	<u>Signal</u>
1	Chassis Ground	14	Input Port Bit 2
2	Input Port Status Bit	15	Input Port Bit 3
3	Input Port Control Bit	16	Input Port Bit 4
4	Input Port Bit 0 (LSB)	17	Input Port Bit 5
5	Input Port Bit 1	18	Input Port Bit 6
6	Ground - Signal Return	19	Input Port Bit 7
7	Ground	20	Output Port Bit 0
9	+8 V Raw Power	21	Output Port Bit 1
10	Output Port Bit 6	22	Output Port Bit 2
11	Output Port Bit 7	23	Output Port Bit 3
12	Output Port Status Bit	24	Output Port Bit 4
13	Output Port Control Bit	25	Output Port Bit 5

PLEASE USE THIS FORMAT FOR SENDING YOUR GROUP PURCHASE ORDERS:

TO: Dr. Thomas A. Clark, WA3LND/W01UF
AMSAT -- Computer GPP
P.O. Box 27
Washington, DC 20044

FROM: _____ CALL: _____

ADDRESS:

CITY STATE ZIP

AMSAT MEMBER NUMBER = DATE:

I hereby authorize T.Clark and/or J.Kasser to act as my agents to purchase the following items for my personal use through the AMSAT Computer Group Purchase plan. I understand that AMSAT has no liability for any purchase made under this plan.

SIGNED

[illegible]

AMSAT GROUP PURCHASE PLAN FOR S-100 BUS MICRO-COMPUTERS
Tom Clark -- WA3LND/W01UF

Since AMSAT's members are among the technical elite of amateur radio, there has been considerable interest voiced about the possibility of AMSAT providing micro-computer hardware and software support for our members. In a companion article, Joe Kasser describes a homebrew 8080/280 micro-computer system based around the hobby-standard IMSAI/ALTAIR/SOL S-100 bus, and the supporting software (including our "AMS80" Monitor/Operating System) that is now available. Joe and I have worked out arrangements with several hardware manufacturers and "friendly" dealers to make S-100 bus peripheral kits available to AMSAT members at a considerable discount from retail prices. To achieve these remarkable discounts, it is necessary for us to dictate certain ground-rules for the Group Purchase Plan (G.P.P.): (1) Joe and I will act as your agents to obtain the best possible prices, but we aren't in the computer business. Our other AMSAT responsibilities make it difficult to offer personalized service, but we'll do our best to help. (2) Payment must be in advance for all items ordered. All checks should be payable to T.A.Clark. (3) We reserve the right to "pool" orders to get the best deal. Therefore, we may wait a few weeks to place orders, and delivery times may be as long as 60-90 days. (4) Except for a few items that we buy in bulk, we have no stock. (5) We will not attempt to repair or maintain your boards. If you have problems, deal directly with the manufacturer. If you feel that you will need personalized help, then buy directly from your local hobby computer store; their business is to provide services. (6) The prices reflected below are only a few percent above actual costs. This margin insures that we will not personally lose any money on the G.P.P. The small "profit" margin will be used to help support AMSAT's Phase-III satellite program, but AMSAT has no liability for any losses sustained by the G.P.P. (7) Nearly all the G.P.P. products have been used by us. We make every effort to insure that you won't get stuck with junk. (8) We want to add additional quality G.P.P. products; if you are a dealer or manufacturer, please contact us. If you stumble onto a good deal (for example, EPROMs or Video monitors) and want to offer an item for the G.P.P., contact us, and (if we determine that the item is suitable) we will add it to the G.P.P. (9) You should include a shipping allowance (if you can't pick up your order from us); we suggest that you allow \$0.50, plus \$1.00 per board, plus insurance if desired. Remember that floppy-disk drives weigh several pounds, so plan accordingly. Foreign G.P.P. subscribers should plan on 0.5 kg per board plus duty and insurance, and make payment in U.S. funds. Canadians should contact VE3SAT. (10) Since the AMSAT Newsletter is not a computer journal, we will not publish updated G.P.P. listings very often. Send an SASE if you want the current G.P.P. list or manufacturer's literature on items of interest. Even if you don't order right away, we would like to have an expression of your future interest in the G.P.P., so PSE QSL.

*** REMEMBER -- THE PROCEEDS HELP SUPPORT PHASE-III ! ***

ITEMS CURRENTLY AVAILABLE:

- SOLID STATE MUSIC/CYBERCOM "Blue Boards" -----
- MB-3 = 2k/4k byte EPROM card. Holds up to 16 1702A's with switch selectable wait states for slow chips. Use this board to keep the AMS80 Monitor permanently resident. With all support chips, but no 1702A's ---- \$ 57.00
- MB-4 = 4k byte RAM using 2102A's. Can be kludged to hold 8k of RAM by "piggy-backing" 32 more 2102's. 500 ns cycle time with the 2102's provided. ---- \$105.00
- MB-6 = 8k byte RAM with low power 2102A's. 500 ns cycle time. Memory Protect and Battery Backup. ---- \$190.00
- MB-7 = 16k byte RAM using NEC ~~4110~~ 4kx1 static RAM chips. 200 nsec access time. Memory Protect. ---- \$370.00
- MB-8 = 8k/16k byte EPROM card. Holds up to 16 2708's with all support chips but no 2708's. Board is quite similar to the MB-3, except for using 2708's. ---- \$ 60.00
- VB-1 = Video board displaying contents of 1k byte of on-board low-power 2102A RAM in 16 line x 64 character format. Can generate either inverse video or 48x128 dot matrix graphics. Similar to Processor Tech. and Polymorphics video boards. Both text and graphics supported by software in the AMS80 monitor package. ---- \$150.00
- IO-2 = 8-bit input port and 8-bit output port plus lots of universal "kludge" area for wire-wrap or solder jumper wiring of special circuits, like power-on jump, front panel functions, MWRITE circuitry, USARTs, keyboard inputs, RTTY decoders, special I/O, etc. ---- \$ 38.00
- MT-1 = 15 slot mother board or ALTAIR expander board. This board uses the 100-pin connectors listed below, NOT those used by ALTAIR! ---- \$ 33.00
- XB-1 = 100-pin extender card, with connector ---- \$ 11.00
- Coming soon -- new CPU card and serial I/O card. Send SASE.

NORTH STAR COMPUTERS

- MDS-A= A full micro-floppy disk system for 8080/Z80 S-100 bus systems, including Shugart drive, DOS and Disk BASIC software. Drive can be powered from your mainframe if you have some reserve. Delivery could be up to 90 days so that we can pool orders for best prices. Please allow extra funds for shipping drives! ---- \$550.00
- MDS-D= Extra drive for MDS-A (price approximate)--- \$390.00
- MDS-C= Small cabinet for Shugart-type disk drives---- \$ 35.00
- MDS-P= Power supply for each Shugart drive. ---- \$ 35.00
- Other North Star products also may be available. SASE please.

USEFUL PARTS AND COMPONENTS

- 100-pin edge connector with gold-flashed contacts. Fit IMSAI, SOL 8 MT-1 boards. Solder-tail and/or wire-wrap type, with the wire-wrap type the more universal. Either fits these boards, so we will ship what we have, unless you specify that you need the wire-wrap type. ---- \$ 4.00
- IMSAI-type nylon card edge guides, per pair. ---- \$ 0.40
- 1702A U.V. EPROM's --- prime from Intel/AMD/TI ---- \$ 4.50
- 8080 chip set = 8080A + 8212 + 8214 + 8216 + 8224 + 8228 + 8251 + 8255, prime from Intel/AMD/NEC ---- \$ 50.00
- T.I. Low-profile solder-tail 9 pin ---- \$ 0.17
- DIP sockets, with 14 pin ---- \$ 0.20
- tin-dipped contacts 16 pin ---- \$ 0.22
- (10 each minimum order) 22 pin ---- \$ 0.37
- 24 pin ---- \$ 0.38
- 28 pin ---- \$ 0.45
- 40 pin ---- \$ 0.64

DIRECT VHF/UHF OPERATION

COMPILED BY WILL WEBSTER, WB2TNC

This listing was prepared from information gained on the East Coast AMSAT net. It is presented in the spirit of "What do I do until the satellites come over?"

- Northeast:
1. 144.110 ssb, 144.10 cw Any night 8-9 PM on the hour.
 2. 432.010 all modes especially Mondays around 9 PM.
 3. 1296.010 around 8 PM Mondays coordinated on 144.11 W3MHU, K1PXE, W1XZ.

Middle Atlantic States:

1. 144.110 ssb, 144.10 cs, 145.025 ssb, 145.1 ssb (last is somewhat sporadic).
2. 432.010 evenings around 9 PM local.
3. 1296.010 evenings W3AED, W4FJU.

South:

- Carolinas: 1. 432.010 Wednesdays around 9 PM local.

Louisville area:

1. 432.010 Around 9 PM most evenings.

- Florida:
1. 145.1 9 PM local most evenings. Not much on 144.11
 2. 432.005 10 PM local.

Also: VE3SAT 9-9:30 each evening 432.010 (running KW).
VP9BI available for schedules Tommy Hall 809-298-0254.

AMSAT GRATEFULLY ACKNOWLEDGES DONATIONS OF \$100.00 OR MORE FROM THE FOLLOWING NEW LIFE MEMBERS:

LM-611 William R Jackson, Jr., W3EZ	LM-634 Edward L. Hayden, K3OKL
LM-612 Lawrence E. Olson, WB8MYG	LM-635 Russ Seibert, WA5PQI
LM-613 Jack Dietrick, WA9AHZ-WA9ZHG	LM-636 Thomas E. Lenon, WD8IBW
LM-614 Hugh Compton, W7MKW	LM-637 McKinley Robinson, Jr., WA4HGX
LM-615 M. A. Henriques, Jr., HC2HX	LM-638 Patrick Hamptaux (Belgium)
LM-616 H. L. Beard, WA2FLX	LM-640 Bert C. de Kat, VE3DPB
LM-617 William T. Tegtmeier, WB3ALG	LM-641 John A. Meyer, W5MQR
LM-618 William U. Weller, W8AEC	LM-642 C. William Bechtold, WD8APV
LM-619 James F. Petrey, WA4QHJ	LM-643 E. V. Hicks, K4HJE
LM-620 Dr. M. Herrera Lutteroth, XE1RX	LM-644 Richmond A. Sweet (Providence RI)
LM-621 G. L. Carman, WA5NOM	LM-645 Clive R. Oakes, VE3YB
LM-622 W. G. Hoover, WD5CYF	LM-646 Clyde V. Taylor, W5OXN-W7CKL
LM-623 Jon Neary, W1UA	LM-647 Dr. James Hale, W4IY
LM-624 Robert Lee, W8RL	LM-648 James M. Lucas, Jr., WB3BDQ
LM-625 J. J. Ketterlinus, Jr., K3JLF	LM-649 Raymond V. Johnson (Daly Cty, CA)
LM-626 W. J. English, W7LHI-WA7KZT	LM-650 Erland Belrup, SM7COS
LM-627 L. W. Campbell, WA4WDN	LM-651 D.C. (Jim) Langdon, KL7FA-VP2GFF
LM-628 Charles L. Wappner, WD8IYC	LM-652 Richard W. Bendicksen, N7ZL
LM-629 C. Wayne Schuler, K9ZEO	LM-653 Robert B. Morgan, WB5AOH
LM-630 Louis P. Goetz, K5WK	LM-654 Adam D. Goettl, WB7NLW
LM-631 Arthur C. Chomacke, K9PUR	LM-655 R. S. Carey (Aurora, OH)
LM-632 Arthur G. Reterstoff, W7PRA	
LM-633 Dale D. Jones, K5MM	

IMS-25 Radio Amateur Union of Northern Greece (Thessaloniki, Greece)
LMS-26 Associated Radio Amateurs of Long Beach (Long Beach, Calif.)
LMS-27 Northwest Arkansas Amateur Radio Club (Rogers, Ark.)
LMS-28 Federation of Eastern Mass. Amateur Radio Associations (Andover, Mass.)

MINUTES OF BOARD OF DIRECTORS MEETING, 5 JUNE 1977

The 5 June 1977 meeting of the AMSAT Board of Directors was called to order at 2010 EDT at AMSAT Headquarters, 700 7th Street S.W., Washington, D.C., by AMSAT President, Perry Klein. The following attended the meeting:

Perry I. Klein, W3PK
Thomas A. Clark, WA3LND
Jan King, W3GEY
William A. Tynan, W3XO
Richard Daniels, WA4DGU

Robert J. Carpenter, W3OTC
Joe Kasser, G3ZCZ
Clark Greene, K1JX
Ed Kalin, K1RT

There was a discussion about finding suitable space for AMSAT activities. King will be temporarily moving to an apartment in a couple of weeks, so the substantial AMSAT work done in his basement will be displaced. The NIH club, where membership processing takes place, will be losing their quarters in the next year, etc. It was decided that a search be confined to laboratory-industrial-warehouse rental space in the Riverdale-Greenbelt vicinity. Local members will be asked to assist in this search.

K8MYN will be contacted further concerning his generous offer of radio equipment to AMSAT. Klein will write him. A policy was adopted that the equipment will not be accepted until AMSAT is in a position to actually use a major portion of it.

Dr. Gschwindt will be here from Hungary later this summer so that an operations department meeting should be held, perhaps in Newington with him, K1HTV, VE3SAT, and others.

The launch of Landsat and AMSAT-OSCAR D seems to be sure to slip until March 1978.

There was further discussion of suitable quarters for AMSAT. Clark and King will look into a trailer at the Goddard Radio Club site. Walt Rader, WA3DMF, will be asked to look for rental quarters. Size to be about 1000 sq. ft. at a cost to be as much less than \$5000 a year as possible. A work party will gather in the next couple of weeks to empty the King basement of AMSAT property.

W4GSH was voted an OSCAR achievement award for his dedicated service to the program.

There was a discussion of the necessity of prompt dispatch of the September Newsletter if it is to contain ballots for the Board of Directors meeting in early October. It was decided that a separate mailing of ballots be made if the Newsletter will not be ready in time.

G3ZCZ assured the meeting that he could get the September Newsletter out in time if everyone cooperates.

There was a discussion of policy concerning Board of Director/"Head-quarters" participation in Hamfests. Clark advocated that each B of D member attend at least one meeting of the importance of an ARRL Division/National convention/Dayton Hamvention/etc. each year. King pointed out that there are so many other hamfests that time and money considerations discourage participation by people from Washington. Clark advocated that we BUY a booth at Dayton next year to get a better site. Klein expressed considerable reluctance to personally attending such activities in view of the other demands on his time.

King reported on Phase III status. He feels that approval is near for a second flight, this on the upper stage of SSUS (Solid Spinning Upper Stage). It would be piggy-back with a chemical release experiment in December 1979.

ESA is often in contact with DJ4ZC concerning mechanical details for the Ariane launch. Karl has designed tooling to make a 0.5 meter diameter center structure for Phase III, to better suit the application. The structure will be completed soon. Karl has breadboarded some of the transponder. There is a problem that only one-chip versions of COSMAC are available, but the existing boards are for the two-chip version. This should be solved soon. The Telefunken solar cell offer has been evaluated and is unacceptable due to the rapid radiation aging of the proposed cells and price asked.

The Board voted to support a trip to Washington by Meinzer, DJ4ZC, in July. He will bring over Phase III material and attend coordination meetings. Ginner and Browning of Project OSCAR are still investigating the possibility of an Air Force launch in early 1980.

Such support as may be necessary was voted for the operations meeting to plan for AMSAT-OSCAR D, as mentioned above.

King noted that the partial Delta failure in May put its satellite in an orbit quite similar to our Phase III plans. Interested tracking stations should practice with its signals on 137.200 MHz. He also noted that a command station located at a latitude greater than 45 degrees North will be able to command Phase III on every orbit.

Klein reported on AMSAT-OSCAR D. The system has not yet been integrated. AMSAT-DL will build the flight battery charge regulator. The structural work is done, except that some backing plates are still needed. The Antenna Deployment Module and 10-meter antenna coupler have not been built. Marie Marr is progressing with the wiring harness.

Things to be done are: thermal coating; improving surity of turnoff of the Mode-J transponder, assemble a battery from the cells on hand.

The vehicle situation looks good.

There was a discussion of fund-raising results. There has been about a seven-fold increase in the rate of life-member applications, to one or two a day. So far perhaps 50 to 100 solar cell have been sponsored. The cell certificates will be available in a few weeks. The Newsletter will carry a drawing to allow sponsors to locate "their" cells. The ARRL Foundation campaign has received perhaps a hundred donations, mostly modest.

Clark and Kasser are running a group-purchase of microcomputer hardware for Chesapeake Microcomputer Society and AMSAT members. Any excess revenues will go to AMSAT.

About ten minutes of tape from G3IOR discussing abuse of satellite operation was played. He suggested that AMSAT award applicants be required to affirm their following of day, power and band-plan recommendations in the contacts claimed for the award.

There was a discussion in which most present felt that the power rules would be hard to enforce. King strongly urged every effort to keep power levels down. Greene pointed out that most amateur awards include a statement that decisions of the awards committee are final. This should allow the adoption of a suitable statement of following suggested practice by AMSAT award applicants.

Greene pointed out that, by and large, most hams know very little about the USE of the satellites. He suggested that a USER article appear as soon as possible. Kasser plans to write such an article (when he gets the time).

On the FCC 5th Notice of Inquiry for the WARC, Clark summarized the amateur satellite sections. Clark and Klein will get advance AMSAT input to the Advisory Committee on Amateur Radio in time for their next meeting.

The meeting was adjourned at 0050, 6 June 1977.

Robert J. Carpenter, W3OTC
Secretary

(Continued from Page 9)

The "Log Periodic" type of Yagi is independent of frequency over about a 10:1 range. This type of antenna allows multi-band operation with one antenna and without the compromises of traps. The LP requires no special type of match since one-half the composite boom is feed (hot) along with all the elements on that boom half. The second half acts as a balun plus supports the other assembly of dipole halves. Here again economy is stressed. The elements may be clothes line wire or aluminum heli-arc rod swaged into holes in the two-piece main boom structure. Even though the LP has a lot of elements, the gain on any one frequency will not be more than a three element Yagi. In operation, the LP has one element that resonates at the frequency of operation, a longer element behind acting inductively as a reflector and a forward element acting capacitively as a director.

I hope to have inspired some of you that have thought about satellite communications to try it. Contrary to some erroneous belief, large steerable arrays are not needed and high power is for the most part wasted. I used as little as 0.5 watt to set the world distance record, so I'm sure you can do a lot with 100 watts to a GP, dipole, Discone or turnstile. Let's hear you via OSCAR.



"LETTERS AND COMMENTS"



Dear Joe:

I almost forgot to send you the picture of the SSTV signal from DB4EX that I mentioned when you phoned me a few weeks ago. The data is on the back of the photo. This was the first time I heard an SSTV signal from Europe via the satellites and had time to get my monitor warmed up and the tape recorder running before the signal stopped.

Receiving SSTV via OSCAR is much more complicated than on the lower frequencies. Besides the usual tuning problems I have to keep retuning the receiver because of Doppler shift and turning my antenna to keep on the satellite. Tape recording adds another chore. One needs to be an octopus to keep everything in adjustment! The DB4EX signal was very good, however, and some good frames were received. After the pass was over I replayed the tape and took a picture from the screen with an old Model 800 Polaroid, which is the only model that has time exposure. With a very small stop, close-up lens and an 8 second time exposure the pictures turn out fine.

DB4EX did not break so I could not give him a call on my own SSTV. His signals dropped out at LOS while he was still transmitting. I have worked him several times since by SSB and he said he was transmitting for some SSTV group in his area.

Nothing much new otherwise. Am up to 71 countries with the addition of PZ1AP and EA6AU and HP1AC. Heard MLC during the recent DXpedition to San Marino but only on Mode B on one orbit and he seemed to be having receiving problems.

73,
Dick Cotton -
W8DX



Dear Walt:

How does the group at AMSAT Hdgtrs feel about utilizing Slow Scan TV (SSTV) on OSCAR 7 Mode A....I've read where contacts from Hawaii to Japan via OSCAR have been made on SSTV....I have seen some pictures matter-of-fact that were exchanged by both parties.

I'm ready to go, but first, before I do, I wanted to check with AMSAT. I've been in SSTV only a month now and am splitting my time between it and working OSCAR....I'd like to incorporate both of them.

I've run across a lot of guys and gals who operate both SSTV in HF and work OSCAR too....Being the bandwidth is no more than SSB anyway, I'm sure that is one reason the FCC authorized its use.

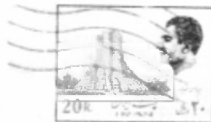
Please advise as soon as possible.

Also, if you give me the go-ahead, how about putting in the following excerpt in the upcoming Newsletter:

SSTV VIA OSCAR???? All interested operators contact WB7BFK, Bill, 4471 40th NE, Oak Harbor, WA 98277. Also, any Asian countries wishing US Confirmations via OSCAR, contact Bill, WB7BFK, and arrange Sked for SSB or SSTV. There are certainly more JA's than just the four that I've worked????

Looks like 11 more states and I'll have WAS -- I can't seem to even catch any Europe??? I work JA with no problem. What's the answer -- I've called CQ on what I felt would be the best passes too! (SSTV is ok. Have you heard Europe yet -- Joe, Ed.)

Bill, WB7BFK



Dear Editor,

Just a short note to say Height of Antenna must be stressed enough! Prior to July 22 I sweated out 18 QSO's in 32 days with double four skeleton slot antenna 18 feet high (surrounded by 70 foot pines and birch). Weekend prior to July 22, this same antenna was hoisted up a stripped pine to 65 feet -- in one day, on passes 12269A - 12270A - 12276A - 12278A - 12279A - 12280A and 12281A made 12 QSO's (inc. 2 with England) running ten watts to an ICOM 211.

So, when late newcomers like myself arrive on scene -- don't tell them "most any antenna will do", the poorer results with an inferior antenna installation might discourage a less stubborn ham than the writer.

A passing note: I would like to report exceptionally long pass duration (LOS is as much as 5 minutes after indicated LOS). I can set my clock on AOS (30 seconds after indicated AOS) but LOS on my signal (10 W) is still Q5 long after beacon fades out. Is this possible? I can offer no explanation, I continue to sign my call, hoping some "heard" cards come in from Asia, as the bird is there and I still copy my own sig. Then there is a sudden, very rapid drop.



73,
Nick Laub, WØCA

Dear Joe,

SUBJECT: The AMSAT Newsletter
Cost vs. Effect
CONGRATULATIONS

As one who is most intimately involved in another area of amateur radio specialty (VHF-UHF repeaters, remote bases, etc.) and responsible for the production of an assortment of newsletters and bulletins, I appreciate very much the monumental effort required to effect the "AMSAT Newsletter".

I, contrary to a letter you received and reported in the Newsletter, feel that this publication is worth every cent spent to produce and distribute it.

The Newsletter at this moment is the only link I personally have with AMSAT in view of my limited direct involvement to date, in the exciting program. At some time in the near future I hope to have my station operational on all modes. But until then, the comprehensive material supplied via the Newsletter is most important serving to keep me as up to date with the program as possible.

Congratulations Joe on a fantastic effort.

73,
Jack Forbing, K9LSB
Member #377 AMSAT

(Thank you very much. -- Joe)

Gentlemen:

Some fellow amateurs and myself are planning an airborne "DX-pedition" on September 17, 1977. Our route of flight will be from San Jose, CA, to Reno, NV, to Las Vegas, NV, to Barstow, CA, to San Jose. We would like to try to work one of the OSCAR satellites during this flight. Our flight time window is proposed to be between 1600 GMT and 2400 GMT on that date. If inclement weather forces postponement of the flight, we will make it the following Saturday, September 24.

The object is to make as many contacts as possible during the flight, including some through OSCAR, if possible.

73,
Alan Christian

Four
Airborne
Amateurs
Reaching
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T



Hi Joe:

Here is some information about my trip to England and Ireland on May 1-8, 1977.

I went to the International Communications Exhibition at Alexandra Palace in London. GB2VHF had a fine setup for OSCAR. They had full sized models of OSCAR 6 and 7 hanging from the ceiling. They looked real good. They also had a board with G3IOR DX cards. They also had slides and a recorder explaining all about OSCAR.

I met G3RWL, G8CSI, G4CBW and G8JHL. I then went on to Ireland and met Jim Malone, EI4N, Ireland's OSCAR Coordinator and Albert EI6AS, the most active station in Ireland on OSCAR. Mode B, 2 meters SSB and FM, 4 meters, and 23 cm. Albert drove me around and worked mobile and also OSCAR Mode B. EI5P, EI9D, EI2W are all on OSCAR also.

In two passes I worked 9 countries on 5/20/77 I3BIE, F1CF, KV4AD, W2LV, G3PEJ, PE2NJC, DB4EX, OE5DJI/3, G8JHL, W4BE. If these stations want a QSL, please QSL via K9RVG (my American call).

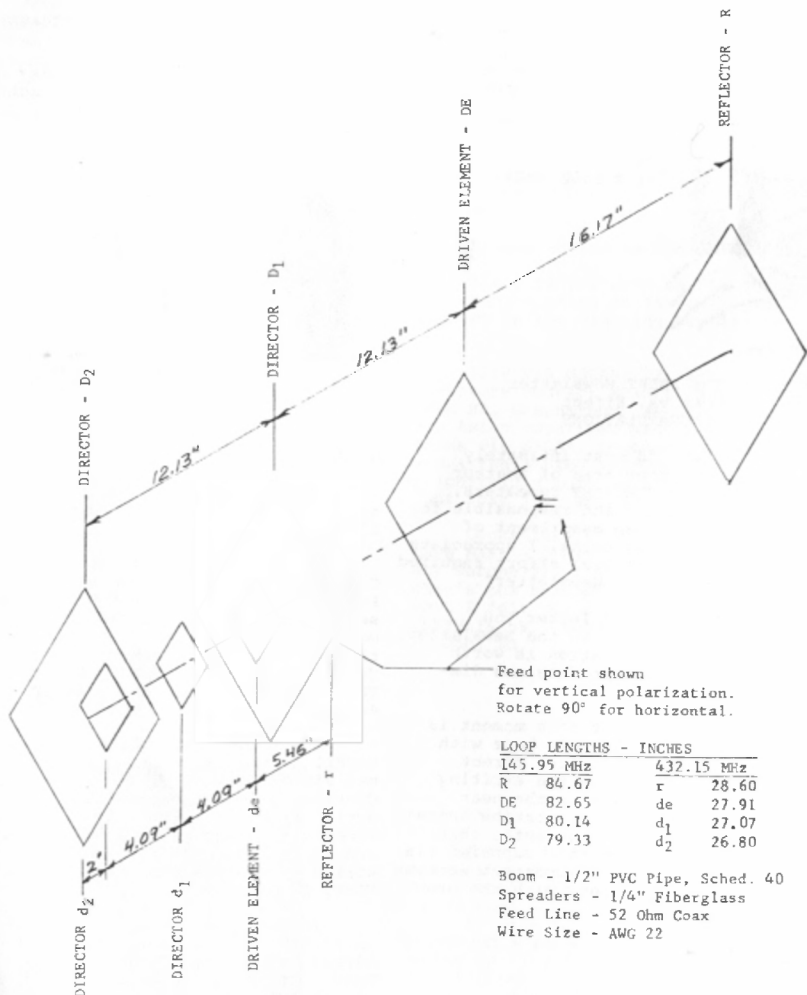
(Continued on Page 27)

A QUAD ANTENNA FOR OSCAR 7 MODE B OPERATION

BY JACK TIELROOY, W6HDT

The sketch shows dimensional data for a simple four element quad antenna for Mode B operation. The 145 MHz quad is based on a design by K6OPS. The 432 was scaled down from the 145 MHz. Construction was by WA6VQM and testing by W6HDT.

We used the antenna on Field Day (June 26, 1977) with excellent results using horizontal polarization. Tests so far indicate that the antenna works best with horizontal polarization.



SILENT KEY

On Friday, July 15, 1977, the Radio Amateur satellite program lost one of its most prolific supporters with the passing of W4GSH, Floyd Forrest. Those who knew him well were familiar with his stories of "mule-back mobile" operation and his many DXpeditions on VHF to mountaintops throughout the country. Listeners to these stories were familiar with his line "Well now, just let me say this...."

Floyd was originally licensed with a W9 call, and was changed to W4FBJ when part of the ninth call area became the fourth. After an absence from Kentucky around 1950, he returned and obtained the call W4GSH which has become so well known to those who worked him. He had been licensed for a total of 46 years.

Floyd had always been interested in VHF and UHF even before it was popular to be so. He had won the "W4KKG Award for 144 MHz DX" in 1948, sponsored by the ARTS club of Louisville, Ky. His interest in the satellite was a natural one, combined with his interest in VHF communication. Floyd was only 2 days behind W2GN/mobile in putting a signal out from Kentucky on OSCAR 6. Floyd had worked the satellites (06, 07) regularly until about two weeks before his death.

Floyd was responsible for almost everyone in Kentucky that is on the satellite: W4MOP, WA4DYL, WB4GZK, WA4JUW, WA4IPI, et al. He supplied not only advice, but antennas, rigs, and even would help assemble stations for those who needed his special brand of consultation.

Floyd had been sick for about a year, but his spirit was undaunted all the way to the end. Those who saw him at the Dayton and Indianapolis Hamfests knew of the weakened condition he was in. His main interest in the last few years was in satellite communication, and his Amateur career was completed on the satellite around July 4, 1977.

In recognition of his interest in the OSCARS, W4MOP proposed that a memorial fund be set up with the objective being to have Floyd's name and call placed aboard the new OSCAR. Collections have been going well, however, we are still far short of the needed \$1000.00. Contributions should be sent to W4MOP or myself, WB4GZK, and checks should be payable to AMSAT. All monies collected will be forwarded to AMSAT at the time the collection is completed.

Everyone should be sorry to lose such a dedicated satellite operator, but none more than those of us who knew him well.

73,
de WB4GZK F. C. (Bo) Lowrey
3805 Hillcreek Road
Louisville, Ky. 40220

(Continued from Page 25)

My Irish call was EI2VJK. For all Irish contacts I QSL'd 100%. Also, I would like to make a comment about the poor rate of QSL returns. I have worked 17 states, got cards from 8, and worked 7 countries, and got a card from only one. Please try and do something in the Newsletter to get the boys to send out the QSLs Cards. (Ed. Note: What do you suggest? -- Joe)

Here is a picture of Albert EI6AS. (Center EI2VJK (K9RVG) Desmond and Jim Malone EI4N, Irish AMSAT Coordinator.)

Hope you can get this picture in the AMSAT Newsletter, as I have never heard of hams in Ireland getting in any magazine. So hope you can help. The picture was taken by Mrs. Malone in their front yard.



73's, yours hamfully,
Desmond G. Giggins
K9RVG/EI2VJK

AMSAT NETS

The following AMSAT Nets meet regularly to disseminate information to newcomers and to keep regular satellite users in communication with one another.

USA-East Coast Net	Wednesdays	0100 Z	3850kHz LSB	Net Control W3UN or WA3NAN
USA-Midcontinent Net	Wednesdays	0200 Z	3850kHz LSB	Net Control W0CY
USA-West Coast Net	Wednesdays	0300 Z	3850kHz LSB	Net Control W6DOW
JA-Net	Mondays	1300 Z	3555kHz LSB	Net Control JALANG
Asia-Pacific Net	Sundays	1100 Z	14,280kHz USB	Net Control JALANG
Western Europe Net	Sundays	1000 Local	3780kHz LSB	Net Control G3RWL
International Net	Sundays	1800 Z	14,280kHz USB	Net Control W3ZM or W3UN
	Sundays	1900 Z	21,280kHz USB	Net Control W3ZM or W3UN
Africa-Europe Net	Sundays	1700 Z	14,280kHz USB	Net Control G3IOR
	Saturdays	1000 Z	14,280kHz USB	Net Control G3IOR
Africa Net	Saturdays	1100 Z	14,280kHz USB	Net Control TU2EF
	Saturdays	1130 Z	21,280kHz USB	Net Control TU2EF

The following VHF frequencies are also in use:

London, England	144.28MHz USB	Net Control G8CSI	Sundays	1930 Local
Atlanta, Georgia	145.80MHz USB/CW	Net Control WA4DDH	Sundays	2000 Local
Washington, D.C.	146.25-85MHz FM	Net Control W3UN	Wednesdays	0000 Z
Los Angeles, Calif.	146.25-85MHz FM	Net Control W6CG	Daily	

Bulletins of general interest to those interested in amateur satellites are now transmitted regularly on AMSAT-OSCAR 7 reference orbits, at approximately 10 minutes after equatorial crossing. These bulletins are transmitted on a downlink frequency of approximately 29.44 MHz on Mode A days, and 145.975 MHz on Mode B days and can be received over most of Eastern North America.

Hurricane advisory bulletins and alerts are also transmitted on AMSAT-OSCAR 7 reference orbits on 29.43 MHz during the Summer-Fall hurricane season.

Educational bulletins via OSCAR have been terminated for the summer during school recess. Write Steve Place, WB2IGW, ARRL Educational Program Asst. at ARRL Headquarters, 225 Main Street, Newington, Conn. 06111 for OSCAR educational bulletin schedules for the Fall semester.

AMSAT-OSCAR QSL BUREAU

Dennis Grindrod, WALEHF
564 Stillman Street
Bridgeport, CT 06608
(203) 579-1921

is serving as AMSAT QSL Manager for OSCAR cards in the United States. U. S. users should send several #10 (business-size) SASE's, which will be filled with incoming QSL cards and mailed when full. Outgoing DX OSCAR QSL's will be forwarded at a rate of 6¢ per card or 20 cards for \$1.00. Domestic QSL's (U. S., Canada, and Mexico) can be sent free in bulk. These will be sorted and placed in the SASE's.
ATTENTION: Those with new call letters, please file new envelopes with the QSL Bureau.

NOTICE OF 1977 AMSAT BOARD OF DIRECTORS ELECTION

Four positions on the Radio Amateur Satellite Corporation Board of Directors are to be filled by the present election. Ballots must be received at or before the AMSAT Annual Meeting to be held at 8 PM, October 8, 1977, at the Employees Recreation Center, Goddard Space Flight Center, Greenbelt, Maryland. Mail ballots should be sent to: AMSAT, Elections Secretary, PO Box 27, Washington, DC, 20044. Be sure to put your name, membership number and zip code (USA members only) on your mailing envelope so that your vote can be validated.

The following members have been nominated and are willing to serve if elected:

Dr. Martin R. Davidoff, K2UBC, Baldwin, Maryland

Jan A. King, W3GEY, Crofton, Maryland

Dr. Perry I. Klein, W3PK, Washington, D.C.

Dr. Earl F. Skelton, N3ES, Washington, D.C.

Randall Smith, VE3SAT, Barrie, Ontario

Dr. William J. Webster, Jr., WB2TNC, Seabrook, Maryland

(Charles A. Dorian was nominated but requested that his name be withdrawn from consideration in order to give others an opportunity to serve on the Board.)

Vote for up to four (4) of the above as soon as possible. A ballot sheet is contained on page 31 of this issue of the AMSAT Newsletter.

Further information supplied by nominees:

Dr. Martin R. Davidoff, K2UBC

- First licensed in 1957, now Extra Class, also first Phone (Commercial). AMSAT life member #338. Nominated by NIH Radio Club.
- AMSAT Activities: Responsible for devising and testing techniques for determining the orbital elements of AMSAT-PHASE III-A after launch.
- Other Amateur Activities: Author of numerous articles, talks, etc.
- Professional Activities: Ph.D. Physics, Syracuse Univer., now Asst. Prof., Catonsville Community College, Baltimore, Md. Director NSF project SED 75-17333 "Using Satellites for Science Instruction".

Jan A. King, W3GEY

(Information supplied by Secretary)

- AMSAT member #2. Nominated by OK7ULZ VHF Group and AMSAT-Mexico.
- AMSAT Activities: Vice-president for Engineering; member Board of Directors since formation of AMSAT in 1969; currently Phase-III Project Manager; was Project Manager for OSCAR 5, 6 and 7.
- Professional Activities: Member of professional staff, Goddard Space Flight Center, NASA.

Dr. Perry I. Klein, W3PK

- First licensed in 1957, Extra Class since 1959, First Phone (commercial). AMSAT life member #1. Nominated by AMSAT-Mexico and NIH Radio Club.
- AMSAT Activities: President and member of Board of AMSAT since its formation in 1969. Responsible for all aspects of AMSAT's activities and day-to-day operations. Employed by AMSAT since summer of 1973. Developed two-to-ten meter transponders for AMSAT-OSCAR 6, 7, and AO-D. Currently serving as Project Manager of AMSAT-OSCAR-D Project.
- Amateur Activities: Past president of Univ. of Penna. Radio Club and COMSAT Amateur Radio Club.
- Professional Activities: Ph. D. in Electrical Engineering, 1968, from Univ. of Penna. with specialty in communications and navigation satellites. Engineer on Technical Staff of COMSAT and COMSAT Labs, 1968-1972. Two patents on navigation satellite system and over two dozen publications in communications, navigation, and transportation.

Dr. Earl F. Skelton, N3ES

- First licensed in 1955, now Extra Class. AMSAT life member #103. Nominated by Naval Research Lab Amateur Radio Club.
- AMSAT Activities: AMSAT awards manager; also updates (with input from WB2DNN) and maintains OSCAR users directory; wrote and distributed OSCAR AZ/EL calculation routine. (Newsletter-March, 1976).
- Amateur Activities: Interests include satellite, EME, coherent CW, DX, and contests; holds WAC, WAS, DXCC, and 5 satellite certificates; organizer and instructor of amateur radio training classes at NRL and Prince George's College; past president NRL ARC.
- Professional Activities: Ph. D. -- solid state physics; Section head -- Phase Transformation Sect., Cryogenics and Superconductivity Branch, Naval Research Lab; Associate Prof. Lecturer in Engineering, George Washington Univ.

Randall Smith, VE3SAT

(Information supplied by Secretary)

- AMSAT life member #46. Nominated by Connecticut Wireless Association.
- AMSAT Activities: Chief command station, OSCAR 6 and 7.
- Amateur Activities: Long-time VHF operator.
- Professional Activities: Member, Royal Canadian Air Force.

Dr. William J. Webster, Jr., WB2TNC

- First licensed 1965. AMSAT life member #89. Nominated by Goddard Amateur Radio Club.
- AMSAT Activities: Net Control Station at WA3NAN for East Coast AMSAT Net. Maintains orbits of current satellites, analyzing orbit for AMSAT-OSCAR-D, provides predictions for command stations.
- Amateur Activities: Principal instructor, Novice classes, vice-president -- Goddard Amateur Radio Club.
- Professional Activities: Member scientific staff, Geophysics Branch, Goddard Space Flight Center. Involved in Seismology, radio astronomy, relay of data from remote locations by satellite.

SPACECRAFT TRANSPONDER FREQUENCIES

SPACECRAFT	UPLINK	DOWNLINK	BEACON
A-O-D (planned)	A 145.85 - 145.95 MHz J 145.90 - 146.00 MHz	29.40 - 29.50 MHz 435.10 - 435.20 MHz	29.400 MHz 435.095 MHz
A-O-7			
(Mode A)	145.85 - 145.95 MHz	29.40 - 29.50 MHz	29.502 MHz
(Mode B/C)	432.125 - 432.175 MHz	145.975 - 145.925 MHz	145.972 MHz
(Mode A/D)	-	-	435.10 MHz

QRM ON 29.502 MHz

Recently, TU2EF reported hearing a complex telemetry signal just above the OSCAR 7 ten-meter beacon. Hugh described this signal as sounding like 'bagpipes'. It appeared at about 1800UTC and was heard for periods as long as two hours. The signal was also heard by W3KH. The signal has been identified as the second harmonic of a 14.751 telemetry signal. The signal is remarkable in that it is obviously from a terrestrial station. We are attempting to locate the transmitter site so we can tell them about their second harmonic problem. Beam headings from anyone receiving this signal would be appreciated.

Don't forget to separate BALLOT and RENEWAL APPLICATION before mailing.

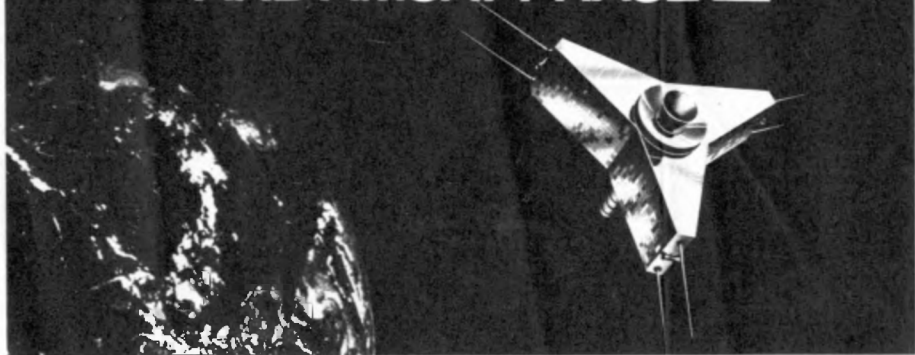
BALLOT SHEET

Vote for up to four (4) candidates and mail to AMSAT, Elections Secretary, P.O. Box 27, Washington, D.C. 20044 U.S.A. Ballots must be received by October 8, 1977.

IMPORTANT: Be sure to include your name, member number and ZIP code (or country if located outside the U.S.) on your ballot mailing envelope, so that your ballot can be validated.

- () Martin Davidoff, K2UBC
- () Jan King, W3GEY
- () Perry Klein, W3PK
- () Earl Skelton, N3ES
- () Randy Smith, VE3SAT
- () Will Webster, WB2TNC

YOU... AND AMSAT PHASE III



An exciting new era in amateur radio
is about to begin — the era of AMSAT PHASE

Your valued, tax-deductible contribu-
tion can be as small as one of the 5000 +